EMISSIONS POST-PROCESSOR DOCUMENTATION

Overview

For the 2004 attainment demonstration, the Georgia Environmental Protection Division (EPD) established the motor vehicle emission budgets (MVEB) using the Atlanta Regional Commission's (ARC) link-based emissions estimation procedure. Using ARC's link-based procedure enables mobile source emission inventories for the State Implementation Plan (SIP) to be calculated in a manner consistent with federal regulations for performing regional emissions analyses used in transportation conformity determinations. This alignment of methodologies for SIP mobile source inventories and transportation conformity regional emissions analyses prevents spurious differences between motor vehicle emission budgets and conformity emissions analyses. The link-based approach:

- Produces link-specific Vehicle-Miles Traveled (VMT) from a capacity-sensitive assignment procedure for the AM, PM, and Off-Peak (OP) time periods.[1]
- Post-processes link-specific speeds from the final assigned volumes for all three time periods using the latest available speed data derived from the 2000 Atlanta Nonattainment Area Speed Study.
- Calculates link-specific emissions for all three time periods.
- Uses the MOBILE5b emission rates for 64 speeds in the 2004 attainment year.

The emissions analysis procedure used for the development of the SIP MVEB integrates data collected from the most recent speed study conducted in the Fall of 2000 by ARC, the Georgia Regional Transportation Authority, EPD, and Georgia Department of Transportation (GDOT). Speed data were used to update volume-delay functions, roadway capacities, and free flow speeds used in the emissions post-processor to determine emission levels for the regional highway network. Post-processed speeds are used for the SIP/MVEB submission because US Environmental Protection Agency (EPA) guidance recommends post-processing speeds from the output of the regional travel demand model.[2]

The emissions estimation process consists of the following seven components and/or steps. Each element is discussed in detail in this document.

1. Constructing the 2004 Highway Network
2. 2004 Loaded Highway Network
3. Time Period Assignment Procedure/Time of Day Model
4. Time of Day Output/Emissions Model Input
5. HPMS Adjustment Factors
6. Speed Post-Processor

[1] "A capacity-sensitive assignment methodology must be used, and emission estimates must be based on a methodology which differentiates between peak and off-peak link volumes and speeds and uses speeds based on final assigned volumes..." Transportation Conformity Rule Amendments: Flexibility and Streamlining; Final Rule, Friday, August 15, 1997, 40 CFR Part 93.122(b)(1)(iv).

[2] Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, EPA-450/4-81-026d, US EPA, Office of Air and Radiation, Office of Mobile Sources, 1992 (http://www.epa.gov/otaq/invntory/r92009.pdf), Section 3.3.5.1, page 31.

7. Calculating Link-Based Emissions

Step 1: Constructing the 2004 Highway Network

To prepare the motor vehicle emission budgets for the 2004 attainment demonstration, it was necessary to create a 2004 transportation network that accurately reflected the current transportation plan and program approved by the US Department of Transportation (USDOT) on July 25, 2000. Already available was the 2003 highway network, required for the conformity determination of the transportation plan and program to the 2003 Attainment SIP submitted by EPD on October 28, 1999. A 2004 highway network was constructed by adding only those transportation projects open-to-traffic by 2004 to the 2003 network already in place.

Step 2: 2004 Loaded Highway Network

To run the 2004 network, it was necessary to develop a set of socio-economic forecasts for the 2004 attainment year. It was originally assumed that 2004 population and employment numbers could be interpolated between the 2000 and 2005 forecasts used for the previous conformity analysis. However, recently released 2000 Census data indicated the need to revise population and employment forecasts to reflect the best and latest available information.

The latest available information on population and employment totals for the 13-county air quality nonattainment area was incorporated into the travel demand model for the 2004 network year. Recently released 2000 Census results indicated an April 1, 2000, population of 3,698,679 for the 13-county air-quality nonattainment area. This is significantly higher than the 2000 forecast population of 3,366,400 used in ARC's adopted forecasts.

Based on ARC's recently released 1999 employment estimates for the 10-county Atlanta Region (1,918,500) and State Department of Labor county estimates for 1999 and 2000, a revised estimate for year 2000 employment in the 13-county nonattainment area was calculated to be 2,056,060. This figure is 5.6 percent higher than the 2000 forecast employment of 1,947,000.

Interpolating between Scenario 4[3] forecast control totals used for the previous conformity analysis, the observed 2000 population was expected to be reached in 2006.6 (significant digit represents tenth of one year, e.g. 0.6 reflects 6 tenths of one year). The projected 2000 employment was expected to be reached in 2003.2. Based on these observations, the current short-term population and employment forecasts in the 13-county air quality nonattainment area are running between 3 and 7 years ahead of the regional forecast series. This is not unexpected. Because long-range forecasting techniques are intended to minimize the influence of the short-term business cycle while capturing longer term trends, observed population and employment should not be expected to perfectly track the forecast trend in the near term.

[3] Scenario 4 refers to the final transportation system modeled for the 2025 RTP, approved by USDOT on July 25, 2000.

It is clear, however that interpolation of a 2004 forecast between the Scenario 4 forecasts for 2000 and 2005 would result in population and employment forecasts that would not compare favorably to best current data on population and employment.

Derivation of Scenario 4 Regional Control Totals

The regional control totals for population, households, and employment by industry were produced in early 1996. They were produced using the Interactive Population and Econometric Forecasting (IPEF) model. A Technical Advisory Group (TAG) of local economists and demographers guided the process of calibrating the model and producing the forecasts. These controls were used for all forecast scenarios evaluated between 1996 and 2001.

Population and employment in the air quality nonattainment area are running ahead of these control forecasts because of the exceptional period of strong economic growth in the United States in the late 1990s. In 1996, the TAG expected that a significant economic slow-down would occur in the late 1990s. This was partly because of an expected slowing in regional growth after the 1996 Olympic Games and partly because the national economy would likely slow from its then-current growth rate.

The second half of the 1990s, however, was a period of unparalleled growth. It was not until March of 2001 that the period of slower national growth that the TAG expected to occur in the late 1990s began.

Indeed, recently released forecasts for the 20-county Atlanta Metropolitan Statistical Area (MSA) (includes the 13-county air quality nonattainment area) produced by the Georgia State University Economic Forecasting Center show much slower growth occurring in 2001 and 2002. While their forecast suggests that reality is moving back toward the forecast trend line, the expected slowing is not sufficient to bring reality in line with the 2005 forecast.

Interim Forecasts for 2004

In order to calculate a more reasonable 2004 population and employment forecast for the 13 county air quality nonattainment area, a Scenario 4 series forecast for 2008 is assumed to occur in 2004. This is equivalent to assuming that the interval between reality and the forecast will fall to four years by 2004. That assumption is consistent with the observed slowing in national economic growth in 2001, the Georgia State Atlanta MSA forecast showing slower growth in 2001 and 2002, and the analysis above that shows population and employment running from 3 to 7 years ahead of the forecast in 2000.

The 2004 network was run with the revised socio-economic forecasts, assuming 2008 population and employment numbers for year 2004. A daily assignment procedure within ARC's four-step travel demand model produced a fully loaded 2004 highway network.

Step 3: Time Period Assignment Procedure/Time of Day Model

Assigning daily traffic volumes to AM, PM, and OP time periods enables ARC to better account for proportionate shares of travel throughout the day. Because vehicle speeds vary significantly throughout the day, the time-of-day distinction is critical to delineating accurate speeds and VMT within the transportation network. Time period assignments are made with the Time-Of-Day (TOD) model. The period assignments include the morning peak period (from 6:30 to 9:30 AM), the evening peak period (from 4:00 to 7:00 PM) and the rest of the day (OP).

The loaded network data output from the daily assignment (Step 2 above) is the input to the TOD model. The highway assignment procedure within the TOD model uses an equilibrium capacity analysis technique to distribute daily vehicle trips to all time periods. The equilibration procedure allows up to 30 iterations of assignment, with the iterations stopping after meeting the closure criterion of 0.01 (the ratio of the summation of the loaded network travel times to the projected summation of loaded travel time after capacity-restrained adjustments for the current iteration). VMT and speeds from the peak and off-peak assignments are based on final assigned link volumes.

Step 4: Time of Day Output/Emissions Model Input

To calculate emissions on a link-by-link basis, loaded network files from the TOD model for each peak period are incorporated into Excel working files - 04lkemam.xls, 04lkempm.xls, and 04lkemop.xls. Loaded network data is found in the "loaded network" worksheet of the working files. Columns are appended to the end of the loaded network data to calculate time of day VMT, post-process speed results from the TOD model, and calculate VOC, CO, and NOx emission levels for individual link records. TRANPLAN's NETCARD program is used to transform the binary TRANPLAN output from the TOD model into an ASCII text file that may be opened in Excel, enabling the data to be used for emission calculations.

Table 1 delineates each column and corresponding field description within a loaded network worksheet. Columns A through Q are the output of the loaded network text files. Columns R and S are additional link attributes coded into the emissions post-processor. Columns T through AH are link attributes calculated within the emissions post-processor.

Table 1
Loaded Network Worksheet

Column	**Field**
A	A Node
B	B Node
C	Assignment Group Classification
D	Distance (hundredths of miles)
E	Field Option (S or T, where S=Speed and T=Time)
F	Free Flow Speed (hundredths of miles)
G	Congested Flow Speed (hundredths of miles)
H	Direction Code
I	Link Group 1 (Default=Facility Type)
J	Link Group 2 (Default=Area Type)
K	Link Group 3 (Default=No. of Directional Lanes)
L	Hourly Capacity
M	Volume for Peak Period
N	B-A Field Option (1,2,S,T)

O		Volume (SOV toll + SOV non toll)
P		Volume (Truck toll + Truck non toll)[4]
Q		Volume (HOV toll + HOV non toll)
R		HPMS Code
S		Posted Speed Limit (hundredths of miles)
T		Assignment Group Index
U		Revised Free Flow Speed Based On Speed Study Results
V		Revised Capacity Based On Speed Study Results
W		V/C Ratio
X		V/C Ratio Index
Y		Revised Congested Flow Speed Based on Speed Study Results
Z		Comparison of Post Processed Speeds and Speeds Direct From Model
AA		HPMS Adjusted Total VMT
AB		VOC Emissions With Low Sulfur Georgia Gasoline
AC		CO Emissions
AD		NOx Emissions With Low Sulfur Georgia Gasoline
AE		VOC Emissions Without Low Sulfur Georgia Gasoline
AF		CO Emissions
AG		NOx Emissions Without Low Sulfur Georgia Gasoline
AH		VHT
AK	HPMS Adjustment	HPMS Functional Class
AL		HPMS Adjustment Factor

Step 5: HPMS Adjustment Factors

To ensure off-model travel[5] is accounted for within regional emission estimates, EPA requires Highway Performance Monitoring System (HPMS)-based forecasts of VMT for emission analyses[6] and recommends that HPMS adjustments be made based on comparison of base year VMT from the transportation model to base year HPMS data.[7]

For the 2003 attainment SIP, per EPA guidance for VMT projections, 2003 VMT in the 13-county Atlanta ozone nonattainment area were "forecast...by applying growth factors based on a validated network-based travel demand modeling process to [the latest available] actual annual VMT estimate."[8] Emissions budgets for the 2003 attainment demonstration were developed using VMT grown from 1997 summer-adjusted HPMS estimates of VMT, the most recent available at the time. To ensure consistency between

[4] Within the ARC travel forecasting model chain the distinction is truck *usage*, i.e. a vehicle is classified as a truck if it has a commercial use, defined by either commercial registry plates or commercial markings on the vehicle. Personal use pick-up trucks, SUVs, minivans, etc. are defined as autos (SOV or HOV). The trip generation and distribution of trucks in the model set is based on a survey of commercial truck use conducted in 1997, Atlanta Area Commercial Vehicle Survey.

[5] Travel that is accounted for within HPMS data counts, but not accounted for within the coded transportation network.

[6] "Highway Performance Monitoring System (HPMS) estimates of vehicle miles traveled (VMT) shall be considered the primary measure of VMT..." 40 CFR Part 93.122(b)(3).

[7] "For areas with network-based travel models, a factor (or factors) may be developed to reconcile and calibrate the network-based travel model estimates of VMT in the base year of its validation to the HPMS estimates for the same period. These factors may then be applied to model estimates of future VMT." 40 CFR Part 93.122(b)(3).

[8] Section 187 VMT Forecasting and Tracking Guidance, US EPA, January 1992 (http://www.epa.gov/oms/transp/vmttrack/vmtguide.zip), Section 4.2 -- also see Section 5.1.

the 2003 attainment demonstration and the emissions analysis for the previous conformity determination, ARC adjusted model VMT using factors calculated from the ratio of 1997 HPMS to 1997 model VMT to capture off-model travel volumes.

For the 2004 attainment demonstration, HPMS adjustment factors based on 1999 HPMS VMT, the most recent HPMS data available, were developed and applied to 2004 model VMT. Because a transportation network was not created for the year 1999, a strict linear interpolation[9] was applied to 1995 and 2000 model VMT results to calculate 1999 model VMT.

Although HPMS functional classification is coded for each link in the highway network within ARC's Transportation Network Management System (TNMS) database, the ARC travel demand model does not report loaded network assignment results by HPMS functional classification. This is due to field limitations within TRANPLAN which limit how many link attributes may be reported, despite how many are coded within the TNMS database. In the past, ARC has chosen to report data by assignment group and area type rather than HPMS functional class. Because the HPMS field was not used for reporting transportation model results, the field codes were not maintained over time within the TNMS database. For this reason, it was necessary to recode each link in the 1995 and 2000 networks with an accurate and up-to-date HPMS code to interpolate 1999 HPMS adjustment factors.

Reference, elsewhere in Appendix XXXI: Assignment of HPMS Functional Classification and Posted Speed Limit Attributes to the Atlanta Regional Commission Highway Network (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/HPMS_and_Posted_Speed_Coding.pdf)

The development of 1999 HPMS adjustment factors required reconsideration of the 1995 and 2000 control totals used to produce the Scenario 4 forecasts.

The 1995 population and employment controls were based on the best available census-tract estimates of population and employment in 1995. For that year, ARC included all 13 counties in its employment estimation program, so good data were available for all counties. These estimates are the best available data for 1995.

ARC annually estimates population and housing by census tract within the 10-county Atlanta Region. The 1995 ARC estimates were used for the 10 member counties. County level estimates for 1995 produced by the U. S. Bureau of the Census were used as the basis for developing tract-level estimates for the three other nonattainment area counties, Coweta, Forsyth, and Paulding. The county totals were allocated to tract based on historical trend and expert opinion. These tract totals were the base for forecasting to the year 2000.

[9] "Since travel demand model output will be unavailable for some of the required VMT forecasting years...the state should linearly interpolate between chronologically adjacent travel demand model scenario years...." Section 187 VMT Forecasting and Tracking Guidance, Section 4.2.

Recently released 2000 census data show ARC's 10 counties to have a population of 3,429,379 persons as of April 1, 2000. ARC's estimate for the 10-county region, 3,304,000, is 3.7 percent lower than the census result. This confirms the effectiveness of ARC's population estimation methods and the appropriateness of their use in developing controls for 1995.

Comparison of the best available year 2000 population and housing data for the 13-county air quality nonattainment area with the Scenario 4 regional controls show that the observed totals were expected to occur in 2008.1 for population and 2003.2 for employment. Based on this observation, the 2005 forecast was treated as the interim 2000 forecast. The 2000 network was re-run with the revised socio-economic forecasts, assuming 2005 population and employment numbers for year 2000.

The following equation was used to calculate the HPMS adjustment factors:

$$\text{HPMS Adjustment Factor}_i = 1999 \text{ HPMS VMT}_i / 1999 \text{ MODEL VMT}_i$$

i = HPMS functional class code

To determine the "1999 HPMS VMT," summer adjusted 1999 daily VMT was calculated by the 12 HPMS facility types for each of the 13 nonattainment counties (99vmt13.xls). Summer adjustment factors, calculated by GDOT's Office of Information Services (OIS), are updated every third year. The OIS also produced the 1999 445 report containing 1999 HPMS VMT for the entire state. The 445 report provides information on mileage and VMT by route type and road system and contains county-specific State Route, County Road, and City Street mileage and VMT broken down by Functional Classification. The HPMS data used for the 2004 attainment demonstration falls within the current 3-year time frame, thus the summer adjustment factors used (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/sumfact.pdf) are the latest available.

Summer adjusted VMT by county and facility type was aggregated to total VMT by HPMS facility type (99sumvmt.xls).

To determine the "1999 MODEL VMT," VMT by HPMS functional class derived from the travel demand model was calculated for 1995 and 2000 within the hwtotm95.lod and hwtotm00.lod files, respectively. A strict linear interpolation between 1995 and 2000 was then applied within the 95_00 interpolate.xls file to compute 1999 MODEL VMT by HPMS functional class. The HPMS adjustment factors were calculated using the equation detailed above.

The HPMS adjustment factors were applied to link-based VMT results within the emissions post-processor to calculate HPMS-based forecasts of VMT (Column AA).

Table 2
1999 HPMS and 1999 Model VMT

HPMS Functional Class	1999 HPMS VMT	1999 Model VMT
1 – Rural Interstate	5008003.30	8019458.85
2 – Rural Principal Arterial	4054585.52	2995672.12
6 – Rural Minor Arterial	3816715.92	2110708.92
7 – Rural Major Collector	3346302.87	3206511.66
8 – Rural Minor Collector	1288421.44	1155811.48
9 – Rural Local	2332123.40	12543834.96
11 – Urban Interstate	36269537.86	31983976.95
12 – Urban Freeway/Expressway	5456793.43	2186946.08
14 – Urban Principal Arterial	15324156.29	14278530.06
16 – Urban Minor Arterial	16873123.05	19118325.03
17 – Urban Collector	7003075.14	7251410.67
19 – Urban Local	17316512.89	12341996.18

Table 3
HPMS Adjustment Factors

HPMS Functional Class	Adjustment Factor
1 – Rural Interstate	0.62
2 – Rural Principal Arterial	1.35
6 – Rural Minor Arterial	1.81
7 – Rural Major Collector	1.04
8 – Rural Minor Collector	1.11
9 – Rural Local	0.19
11 – Urban Interstate	1.13
12 – Urban Freeway/Expressway	2.50
14 – Urban Principal Arterial	1.07
16 – Urban Minor Arterial	0.88
17 – Urban Collector	0.97
19 – Urban Local	1.40

Step 6: Speed Post-Processor

Output from the time of day model after a fully equilibrated assignment procedure is link-based Vehicle-Hours Traveled (VHT) and VMT. Link-specific modeled speeds are calculated accordingly by dividing VMT by VHT.[10] Time of day model speeds are reported in the emissions model as congested flow speed (column G). Congested flow speeds are *not* used to estimate emissions. To reconcile model speeds to observed speeds using data from the recently completed speed study, a post-processor is applied within the Excel working files. The post-processor is comprised of a series of nine volume-delay

[10] The VHT reported in the emissions workbook is not output from the time of day model. It is a post-processed VHT calculated within the emissions working files. The VHT calculated for each link uses the link VMT divided by the post-processed speed to compute a post-processed time. The VHT reported in the emissions workbook is *not* used to determine link-based emission levels for the development of the MVEB.

curves by roadway facility type[11] translated into a lookup table that defines a speed reduction factor for a facility type and volume-to-capacity (v/c) ratio combination ("new vdf" worksheet). The v/c ratio for a link is the model reported volume multiplied by a conversion factor divided by the revised link-capacity derived from the speed study (Column V). The conversion factor, CONFAC, is used to convert volume (reported as vehicles per peak period) and capacity (reported as vehicles per hour) to a common set of units.

Reference, elsewhere in Appendix XXXI: CONFAC Determination for Post-Processor (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/CONFAC.pdf)

Reference, elsewhere in Appendix XXXI: Development of Vehicle Speed Parameters For Atlanta Non-Attainment Area Emissions Post-Processor Used in 2004 State Implementation Plan
(http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/Speed_Study.pdf)

The volume-delay curves within the lookup table define the relationship between observed speed and observed volume derived from the speed study data. Within the emissions model, the lookup table is used to categorize each link by its assignment group and v/c ratio combination and, subsequently, determine the appropriate speed reduction factor needed to compute a post-processed link speed. The post-processed speed is calculated by multiplying the free flow speed on a link by the appropriate speed reduction factor. An example follows:

Link X is coded as assignment group 9. The link distance is 0.30 miles, the revised free flow speed is 30 mph, the revised hourly capacity is 950, the AM peak period volume is 372 and with a conversion factor of 0.39 the v/c ratio is (0.39 * 372 / 950) 0.15. Based on an assignment group of 9 and a v/c of 0.15, the speed reduction factor is 0.971. (Excel's index function uses the highest v/c ratio without going over, thus this is the value for a v/c ratio of 0.14.) Based on the model parameters the post-processed speed is 30 mph * 0.971 or 29.13 mph. This is the value used in emission calculations.

Step 7: Calculating Link-Based Emissions

Within each time period emissions workbook is a worksheet (the "efacts" worksheet) delineating composite emission factors for each speed from 2.5 to 65 miles per hour, both with and without low sulfur Georgia gasoline adjustments. Low sulfur gasoline adjustments are calculated within the "GA gas calc" worksheet. To calculate the emission reductions resulting from Phase 2 of the gasoline program, EPD used EPA's Final Complex Model spreadsheet to compare the more stringent 30 ppm sulfur standard with Atlanta-area baseline fuel standards. Reductions of 4.4% VOC and 11.7% NOx were calculated. A 4.4% VOC reduction and an 11.7% NOx reduction were applied to emission factors for Light-Duty Gas Vehicle, Light-Duty Gas Truck 1, and Light-Duty Gas Truck 2 vehicle types. The "all vehicles" emission factor was then recalculated by multiplying the emission factors for each vehicle type by the VMT mix fraction for that

[11] Roadway facility types within the ARC model set are referred to as Assignment Groups.

vehicle type, then summing all eight products. This was done for each speed scenario (2.5 mph, then 3 mph to 65 mph, inclusive, in one mile per hour increments[12]).

Emission factors for each speed scenario are incorporated into the "efacts" worksheet to be applied to VMT and speeds for each link. Within VOC, CO, and NOx emission calculations, the post-processed link speed is referenced. If the speed is greater than or equal to 2.5 mph[13] the appropriate VOC, CO, or NOx emission rate is looked up in the emission factor worksheet and applied to the corresponding link VMT to compute link-level emissions in grams. Link-by-link emissions for each time of day period are summed together to estimate total daily emissions (lkemsum04.xls). Total daily VOC, CO, and NOx emissions for the transportation network are then converted from grams per day to tons per day using the 907,180 grams per ton conversion factor. Appropriate off-model adjustments are added to (for senior I/M exemption) and subtracted from (for Partnership for a Smog-free Georgia) the emission levels calculated within the summary workbook to determine the final emission levels for a transportation network. See Section 6 of the 2004 attainment demonstration for a discussion of the off-model adjustments and final emission levels.

Additional Information

The emissions post-processor files, one Excel 97 summary workbook and three time-of-day workbooks, are available on EPD's web page:

> Summary Tables for Mobile Emissions Post-Processor:
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkemsum04.xls)
>
> A.M. Peak Mobile Emissions Post-Processor:
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkemam04.zip)
>
> Off-Peak Mobile Emissions Post-Processor:
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkemop04.zip)
>
> P.M. Peak Mobile Emissions Post-Processor:
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkempm04.zip)

Note that the time-of-day workbooks are large: 11 megabytes compressed, 45 megabytes expanded.

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[12] MOBILE5b does not calculate emissions for speeds less than 2.5 mph.

[13] An "if" statement is used to reference the post-processed speed. If the speed is less than 2.5 mph then the link will assume a speed of 2.5 mph for emissions calculations.

SUMMER-ADJUSTED 1999 DAILY VMT
99vmt13.xls

	SDVMT	
CHEROKEE	552,430.11	Rural Interstate
CHEROKEE	0.00	Rural Principal Arterial
CHEROKEE	364,346.37	Rural Minor Arterial
CHEROKEE	629,045.57	Rural Major Collector
CHEROKEE	233,365.98	Rural Minor Collector
CHEROKEE	288,243.30	Rural Local
CHEROKEE	540,491.57	Urbanized Interstate
CHEROKEE	0.00	Urbanized Other Freeway
CHEROKEE	383,760.00	Urbanized Principal Arterial
CHEROKEE	333,823.91	Urbanized Minor Arterial
CHEROKEE	21,419.80	Urbanized Collector
CHEROKEE	493,365.60	Urbanized Local
CHEROKEE		
CHEROKEE		
CHEROKEE		
CHEROKEE		
CHEROKEE		
CHEROKEE		
CLAYTON	0.00	Rural Interstate
CLAYTON	127,982.47	Rural Principal Arterial
CLAYTON	0.00	Rural Minor Arterial
CLAYTON	74,719.59	Rural Major Collector
CLAYTON	5,093.81	Rural Minor Collector
CLAYTON	25,900.93	Rural Local
CLAYTON	2,895,921.11	Urbanized Interstate
CLAYTON	5,879.40	Urbanized Other Freeway
CLAYTON	1,284,442.62	Urbanized Principal Arterial
CLAYTON	1,151,281.71	Urbanized Minor Arterial
CLAYTON	569,218.61	Urbanized Collector
CLAYTON	1,242,860.39	Urbanized Local
CLAYTON		
CLAYTON		
CLAYTON		
CLAYTON		
CLAYTON		
CLAYTON		
COBB	0.00	Rural Interstate
COBB	0.00	Rural Principal Arterial
COBB	0.00	Rural Minor Arterial
COBB	992.77	Rural Major Collector
COBB	0.00	Rural Minor Collector
COBB	0.00	Rural Local
COBB	6,064,342.08	Urbanized Interstate
COBB	115,370.00	Urbanized Other Freeway
COBB	2,552,957.86	Urbanized Principal Arterial
COBB	3,691,280.80	Urbanized Minor Arterial
COBB	1,331,837.90	Urbanized Collector
COBB	4,059,036.38	Urbanized Local
COBB		

SUMMER-ADJUSTED 1999 DAILY VMT
99vmt13.xls

COBB		
COBB		
COBB		
COBB		
COBB		
COWETA	1,176,073.06	Rural Interstate
COWETA	415,896.97	Rural Principal Arterial
COWETA	723,115.18	Rural Minor Arterial
COWETA	248,281.44	Rural Major Collector
COWETA	115,542.89	Rural Minor Collector
COWETA	438,648.04	Rural Local
COWETA	0.00	Urbanized Interstate
COWETA	0.00	Urbanized Other Freeway
COWETA	0.00	Urbanized Principal Arterial
COWETA	0.00	Urbanized Minor Arterial
COWETA	0.00	Urbanized Collector
COWETA	0.00	Urbanized Local
COWETA		
COWETA		
COWETA		
COWETA		
COWETA		
COWETA		
DEKALB	0.00	Rural Interstate
DEKALB	0.00	Rural Principal Arterial
DEKALB	0.00	Rural Minor Arterial
DEKALB	0.00	Rural Major Collector
DEKALB	0.00	Rural Minor Collector
DEKALB	0.00	Rural Local
DEKALB	9,223,113.69	Urbanized Interstate
DEKALB	1,045,540.99	Urbanized Other Freeway
DEKALB	1,660,258.59	Urbanized Principal Arterial
DEKALB	3,991,784.64	Urbanized Minor Arterial
DEKALB	1,496,183.18	Urbanized Collector
DEKALB	3,202,492.58	Urbanized Local
DEKALB		
DEKALB		
DEKALB		
DEKALB		
DEKALB		
DEKALB		
DOUGLAS	442,627.97	Rural Interstate
DOUGLAS	32,656.70	Rural Principal Arterial
DOUGLAS	47,634.74	Rural Minor Arterial
DOUGLAS	67,669.69	Rural Major Collector
DOUGLAS	75,690.31	Rural Minor Collector
DOUGLAS	56,342.27	Rural Local
DOUGLAS	1,096,997.82	Urbanized Interstate
DOUGLAS	0.00	Urbanized Other Freeway
DOUGLAS	854,947.02	Urbanized Principal Arterial
DOUGLAS	311,048.21	Urbanized Minor Arterial

SUMMER-ADJUSTED 1999 DAILY VMT
99vmt13.xls

DOUGLAS	170,110.99	Urbanized Collector
DOUGLAS	761,984.79	Urbanized Local
DOUGLAS		
DOUGLAS		
DOUGLAS		
DOUGLAS		
DOUGLAS		
DOUGLAS		
FAYETTE	0.00	Rural Interstate
FAYETTE	856,027.12	Rural Principal Arterial
FAYETTE	378,418.23	Rural Minor Arterial
FAYETTE	216,514.02	Rural Major Collector
FAYETTE	118,276.70	Rural Minor Collector
FAYETTE	319,817.94	Rural Local
FAYETTE	0.00	Urbanized Interstate
FAYETTE	0.00	Urbanized Other Freeway
FAYETTE	126,767.97	Urbanized Principal Arterial
FAYETTE	81,874.00	Urbanized Minor Arterial
FAYETTE	11,495.64	Urbanized Collector
FAYETTE	77,131.60	Urbanized Local
FAYETTE		
FAYETTE		
FAYETTE		
FAYETTE		
FAYETTE		
FAYETTE		
FORSYTH	0.00	Rural Interstate
FORSYTH	994,495.87	Rural Principal Arterial
FORSYTH	771,789.80	Rural Minor Arterial
FORSYTH	627,814.43	Rural Major Collector
FORSYTH	100,416.70	Rural Minor Collector
FORSYTH	305,523.71	Rural Local
FORSYTH	0.00	Urbanized Interstate
FORSYTH	0.00	Urbanized Other Freeway
FORSYTH	0.00	Urbanized Principal Arterial
FORSYTH	0.00	Urbanized Minor Arterial
FORSYTH	0.00	Urbanized Collector
FORSYTH	0.00	Urbanized Local
FORSYTH		
FORSYTH		
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FORSYTH		
FORSYTH		
FORSYTH		
FULTON	176,881.72	Rural Interstate
FULTON	78,821.25	Rural Principal Arterial
FULTON	83,489.70	Rural Minor Arterial
FULTON	231,350.53	Rural Major Collector
FULTON	17,310.72	Rural Minor Collector
FULTON	51,159.38	Rural Local
FULTON	12,170,244.31	Urbanized Interstate

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FULTON	3,643,387.03	Urbanized Other Freeway
FULTON	3,782,409.19	Urbanized Principal Arterial
FULTON	4,851,228.28	Urbanized Minor Arterial
FULTON	2,216,175.25	Urbanized Collector
FULTON	4,196,591.98	Urbanized Local
FULTON		
FULTON		
FULTON		
FULTON		
FULTON		
FULTON		
GWINNETT	1,335,657.04	Rural Interstate
GWINNETT	677,292.75	Rural Principal Arterial
GWINNETT	743,705.19	Rural Minor Arterial
GWINNETT	362,354.63	Rural Major Collector
GWINNETT	465,591.96	Rural Minor Collector
GWINNETT	337,334.23	Rural Local
GWINNETT	2,936,540.00	Urbanized Interstate
GWINNETT	646,616.01	Urbanized Other Freeway
GWINNETT	4,182,643.23	Urbanized Principal Arterial
GWINNETT	1,631,185.60	Urbanized Minor Arterial
GWINNETT	1,051,685.15	Urbanized Collector
GWINNETT	2,155,082.38	Urbanized Local
GWINNETT		
GWINNETT		
GWINNETT		
GWINNETT		
GWINNETT		
GWINNETT		
HENRY	1,324,333.40	Rural Interstate
HENRY	221,990.73	Rural Principal Arterial
HENRY	361,071.34	Rural Minor Arterial
HENRY	479,176.69	Rural Major Collector
HENRY	39,857.53	Rural Minor Collector
HENRY	207,815.88	Rural Local
HENRY	617,810.44	Urbanized Interstate
HENRY	0.00	Urbanized Other Freeway
HENRY	265,941.00	Urbanized Principal Arterial
HENRY	335,176.50	Urbanized Minor Arterial
HENRY	32,296.04	Urbanized Collector
HENRY	505,536.60	Urbanized Local
HENRY		
HENRY		
HENRY		
HENRY		
HENRY		
HENRY		
PAULDING	0.00	Rural Interstate
PAULDING	619,071.14	Rural Principal Arterial
PAULDING	315,576.30	Rural Minor Arterial
PAULDING	333,348.45	Rural Major Collector

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PAULDING	85,780.41	Rural Minor Collector
PAULDING	270,721.44	Rural Local
PAULDING	0.00	Urbanized Interstate
PAULDING	0.00	Urbanized Other Freeway
PAULDING	0.00	Urbanized Principal Arterial
PAULDING	0.00	Urbanized Minor Arterial
PAULDING	0.00	Urbanized Collector
PAULDING	0.00	Urbanized Local
PAULDING		
PAULDING		
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PAULDING		
ROCKDALE	0.00	Rural Interstate
ROCKDALE	30,350.52	Rural Principal Arterial
ROCKDALE	27,569.06	Rural Minor Arterial
ROCKDALE	75,035.05	Rural Major Collector
ROCKDALE	31,494.43	Rural Minor Collector
ROCKDALE	30,616.29	Rural Local
ROCKDALE	724,076.84	Urbanized Interstate
ROCKDALE	0.00	Urbanized Other Freeway
ROCKDALE	230,028.81	Urbanized Principal Arterial
ROCKDALE	494,439.40	Urbanized Minor Arterial
ROCKDALE	102,652.57	Urbanized Collector
ROCKDALE	622,430.59	Urbanized Local
ROCKDALE		
ROCKDALE		
ROCKDALE		
ROCKDALE		
ROCKDALE		
ROCKDALE		
	118,089,351.11	

			Rural Interstate	Rural Prin. Arterial	Rural Min. Arterial	Rural Major Collecto	Rural Minor Collecto	Rural Local	Urb. Interstate	Urb. Other Fwy	Urb. Prin. Arterial	Urb. Min. Arterial	Urbanized Collector	Urbanized Local
CHEROKEE	552,430.11	Rural Interstate	552,430.11											
3,840,292.20		Rural Principal Arterial												
	364,346.37	Rural Minor Arterial			364,346.37									
	629,045.57	Rural Major Collector				629,045.57								
	233,365.98	Rural Minor Collector					233,365.98							
	288,243.30	Rural Local						288,243.30						
	540,491.57	Urbanized Interstate							540,491.57					
		Urbanized Other Freeway												
	383,760.00	Urbanized Principal Arterial									383,760.00			
	333,823.91	Urbanized Minor Arterial										333,823.91		
	21,419.80	Urbanized Collector											21,419.80	
	493,365.60	Urbanized Local												493,365.60
CLAYTON		Rural Interstate												
7,383,300.64	127,982.47	Rural Principal Arterial		127,982.47										
		Rural Minor Arterial												
	74,719.59	Rural Major Collector				74,719.59								
	5,093.81	Rural Minor Collector					5,093.81							
	25,900.93	Rural Local						25,900.93						
	2,895,921.11	Urbanized Interstate							2,895,921.11					
	5,879.40	Urbanized Other Freeway								5,879.40				
	1,284,442.62	Urbanized Principal Arterial									1,284,442.62			
	1,151,281.71	Urbanized Minor Arterial										1,151,281.71		
	569,218.61	Urbanized Collector											569,218.61	
	1,242,860.39	Urbanized Local												1,242,860.39
COBB		Rural Interstate												
17,815,817.80		Rural Principal Arterial												
		Rural Minor Arterial												
	992.77	Rural Major Collector				992.77								
		Rural Minor Collector												
		Rural Local												
	6,064,342.08	Urbanized Interstate							6,064,342.08					
	115,370.00	Urbanized Other Freeway								115,370.00				
	2,552,957.86	Urbanized Principal Arterial									2,552,957.86			
	3,691,280.80	Urbanized Minor Arterial										3,691,280.80		
	1,331,837.90	Urbanized Collector											1,331,837.90	
	4,059,036.38	Urbanized Local												4,059,036.38

			Rural Interstate	Rural Prin. Arterial	Rural Min. Arterial	Rural Major Collecto	Rural Minor Collecto	Rural Local	Urb. Interstate	Urb. Other Fwy	Urb. Prin. Arterial	Urb. Min. Arterial	Urbanized Collector	Urbanized Local	
COWETA	1,176,073.06	Rural Interstate	1,176,073.06												
3,117,557.59	415,896.97	Rural Principal Arterial		415,896.97											
	723,115.18	Rural Minor Arterial			723,115.18										
	248,281.44	Rural Major Collector				248,281.44									
	115,542.89	Rural Minor Collector					115,542.89								
	438,648.04	Rural Local						438,648.04							
		Urbanized Interstate													
		Urbanized Other Freeway													
		Urbanized Principal Arterial													
		Urbanized Minor Arterial													
		Urbanized Collector													
		Urbanized Local													
DEKALB		Rural Interstate													
20,619,373.67		Rural Principal Arterial													
		Rural Minor Arterial													
		Rural Major Collector													
		Rural Minor Collector													
		Rural Local													
	9,223,113.69	Urbanized Interstate							9,223,113.69						
	1,045,540.99	Urbanized Other Freeway								1,045,540.99					
	1,660,258.59	Urbanized Principal Arterial									1,660,258.59				
	3,991,784.64	Urbanized Minor Arterial										3,991,784.64			
	1,496,183.18	Urbanized Collector											1,496,183.18		
	3,202,492.58	Urbanized Local												3,202,492.58	
DOUGLAS	442,627.97	Rural Interstate	442,627.97												
3,917,710.50	32,656.70	Rural Principal Arterial		32,656.70											
	47,634.74	Rural Minor Arterial			47,634.74										
	67,669.69	Rural Major Collector				67,669.69									
	75,690.31	Rural Minor Collector					75,690.31								
	56,342.27	Rural Local						56,342.27							
	1,096,997.82	Urbanized Interstate							1,096,997.82						
		Urbanized Other Freeway													
	854,947.02	Urbanized Principal Arterial									854,947.02				
	311,048.21	Urbanized Minor Arterial										311,048.21			
	170,110.99	Urbanized Collector											170,110.99		
	761,984.79	Urbanized Local												761,984.79	

			Rural Interstate	Rural Prin. Arterial	Rural Min. Arterial	Rural Major Collecto	Rural Minor Collecto	Rural Local	Urb. Interstate	Urb. Other Fwy	Urb. Prin. Arterial	Urb. Min. Arterial	Urbanized Collector	Urbanized Local	
FAYETTE		Rural Interstate													
2,186,323.22	856,027.12	Rural Principal Arterial		856,027.12											
	378,418.23	Rural Minor Arterial			378,418.23										
	216,514.02	Rural Major Collector				216,514.02									
	118,276.70	Rural Minor Collector					118,276.70								
	319,817.94	Rural Local						319,817.94							
		Urbanized Interstate													
		Urbanized Other Freeway													
	126,767.97	Urbanized Principal Arterial									126,767.97				
	81,874.00	Urbanized Minor Arterial										81,874.00			
	11,495.64	Urbanized Collector											11,495.64		
	77,131.60	Urbanized Local												77,131.60	
FORSYTH		Rural Interstate													
2,800,040.52	994,495.87	Rural Principal Arterial		994,495.87											
	771,789.80	Rural Minor Arterial			771,789.80										
	627,814.43	Rural Major Collector				627,814.43									
	100,416.70	Rural Minor Collector					100,416.70								
	305,523.71	Rural Local						305,523.71							
		Urbanized Interstate													
		Urbanized Other Freeway													
		Urbanized Principal Arterial													
		Urbanized Minor Arterial													
		Urbanized Collector													
		Urbanized Local													
FULTON	176,881.72	Rural Interstate	176,881.72												
31,499,049.33	78,821.25	Rural Principal Arterial		78,821.25											
	83,489.70	Rural Minor Arterial			83,489.70										
	231,350.53	Rural Major Collector				231,350.53									
	17,310.72	Rural Minor Collector					17,310.72								
	51,159.38	Rural Local						51,159.38							
	12,170,244.31	Urbanized Interstate							12,170,244.31						
	3,643,387.03	Urbanized Other Freeway								3,643,387.03					
	3,782,409.19	Urbanized Principal Arterial									3,782,409.19				
	4,851,228.28	Urbanized Minor Arterial										4,851,228.28			
	2,216,175.25	Urbanized Collector											2,216,175.25		
	4,196,591.98	Urbanized Local												4,196,591.98	

			Rural Interstate	Rural Prin. Arterial	Rural Min. Arterial	Rural Major Collecto	Rural Minor Collecto	Rural Local	Urb. Interstate	Urb. Other Fwy	Urb. Prin. Arterial	Urb. Min. Arterial	Urbanized Collector	Urbanized Local
GWINNETT	1,335,657.04	Rural Interstate	1,335,657.04											
16,525,688.17	677,292.75	Rural Principal Arterial		677,292.75										
	743,705.19	Rural Minor Arterial			743,705.19									
	362,354.63	Rural Major Collector				362,354.63								
	465,591.96	Rural Minor Collector					465,591.96							
	337,334.23	Rural Local						337,334.23						
	2,936,540.00	Urbanized Interstate							2,936,540.00					
	646,616.01	Urbanized Other Freeway								646,616.01				
	4,182,643.23	Urbanized Principal Arterial									4,182,643.23			
	1,631,185.60	Urbanized Minor Arterial										1,631,185.60		
	1,051,685.15	Urbanized Collector											1,051,685.15	
	2,155,082.38	Urbanized Local												2,155,082.38
HENRY	1,324,333.40	Rural Interstate	1,324,333.40											
4,391,006.14	221,990.73	Rural Principal Arterial		221,990.73										
	361,071.34	Rural Minor Arterial			361,071.34									
	479,176.69	Rural Major Collector				479,176.69								
	39,857.53	Rural Minor Collector					39,857.53							
	207,815.88	Rural Local						207,815.88						
	617,810.44	Urbanized Interstate							617,810.44					
		Urbanized Other Freeway												
	265,941.00	Urbanized Principal Arterial									265,941.00			
	335,176.50	Urbanized Minor Arterial										335,176.50		
	32,296.04	Urbanized Collector											32,296.04	
	505,536.60	Urbanized Local												505,536.60
PAULDING		Rural Interstate												
1,624,497.75	619,071.14	Rural Principal Arterial		619,071.14										
	315,576.30	Rural Minor Arterial			315,576.30									
	333,348.45	Rural Major Collector				333,348.45								
	85,780.41	Rural Minor Collector					85,780.41							
	270,721.44	Rural Local						270,721.44						
		Urbanized Interstate												
		Urbanized Other Freeway												
		Urbanized Principal Arterial												
		Urbanized Minor Arterial												
		Urbanized Collector												
		Urbanized Local												

			Rural Interstate	Rural Prin. Arterial	Rural Min. Arterial	Rural Major Collecto	Rural Minor Collecto	Rural Local	Urb. Interstate	Urb. Other Fwy	Urb. Prin. Arterial	Urb. Min. Arterial	Urbanized Collector	Urbanized Local	
ROCKDALE		Rural Interstate													
2,368,693.57	30,350.52	Rural Principal Arterial		30,350.52											
	27,569.06	Rural Minor Arterial			27,569.06										
	75,035.05	Rural Major Collector				75,035.05									
	31,494.43	Rural Minor Collector					31,494.43								
	30,616.29	Rural Local						30,616.29							
	724,076.84	Urbanized Interstate							724,076.84						
		Urbanized Other Freeway													
	230,028.81	Urbanized Principal Arterial									230,028.81				
	494,439.40	Urbanized Minor Arterial										494,439.40			
	102,652.57	Urbanized Collector											102,652.57		
	622,430.59	Urbanized Local												622,430.59	
	118,089,351.11														
118,089,351.11															
			5,008,003.30	4,054,585.52	3,816,715.92	3,346,302.87	1,288,421.44	2,332,123.40	36,269,537.86	5,456,793.43	15,324,156.29	16,873,123.05	7,003,075.14	17,316,512.89	118,089,351.11
			Rural Interstate	Rural Prin. Arterial	Rural Min. Arterial	Rural Major Collecto	Rural Minor Collecto	Rural Local	Urb. Interstate	Urb. Other Fwy	Urb. Prin. Arterial	Urb. Min. Arterial	Urbanized Collector	Urbanized Local	